Wave-Particle Interactions: A Discussion of First-Order Effects

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The physical concepts of wave-particle interactions in a collisionless plasma are developed from first principles. Normal and anomalous cyclotron resonance and concomitant pitch angle diffusion will be discussed. Cross-field diffusion due to resonant interactions (application at boundary layers) and due to magnetic magnitude irregularities will both be discussed. These physical mechanisms are not only applicable to the plasmasphere, but also to the heliosphere (Ulysses) and astrophysics as well.